AN IMPROVED FILIGREE FOR THE REPAIR OF LARGE DEFECTS IN THE ABDOMINAL WALL.[1]

BY WILLARD BARTLETT, M.D.,
OF ST. LOUIS, MO.,
Demonstrator of Surgical Pathology, Medical Department of Washington University.

THE problem which confronts the surgeon in the removal of a large tumor involving the abdominal wall is not how to get it out, but what to do afterwards towards a repair of the damage. If a large section has been cut away, and the operator would completely restore the integrity of the barriers to herniation of abdominal viscera, then he must devise for his patient something which will give greater security than that afforded by the various autoplastic measures of the past. The need of an artificial aid for reinforcing the belly wall has been felt, too, in those cases where an extensive hernia has resulted from the stretching of a scar or from the thinning which is produced when an improperly directed incision disturbs nerve supply and causes muscles to atrophy. Further, the incorporation of foreign substances into the tissues has not been despised even in the treatment of ordinary inguinal and femoral hernia, though it is not my purpose in this article to deal extensively with these two last-named conditions. A large umbilical hernia is, on the other hand, a very different matter, and has surely been regarded as a sort of *bête noir* of surgery by many.

A serious consideration of prophylactic and remedial measures in large herniæ, of whatever nature, is surely justified by the knowledge that the individual thus afflicted can be nothing but a miserable invalid. Not even the best fitting supporter can render life more than bearable, nor is it possible for such a person to make any severe exertion, whether it be in the pursuance of an occupation or in the enjoyment of an athletic sport. None of the autoplastic operations offers a guarantee of success in the treatment of these cases, provided the lesion be extensive, and unfortunately all tend to become so as time passes. It was not until the introduction of the silver-wire filigree that any procedure intended for the betterment of such cases was attended with anything like uniform good results. A step was taken in the right direction when the late lamented Schede commenced to suture simple abdominal wounds with silver wire, but this valuable procedure is of course of no avail in those instances where the lips of a defect cannot be approximated, no matter how great the tension applied, as has been the case in several operations which I shall detail later. It was in the effort to remedy this state of affairs that Witzel constructed in the tissues, during the operation, his first rude net-work of cross-wires, and in so doing suggested to the surgical world the idea of embedding a ready-made filigree. He drew the edges of the wound as near together as possible with ordinary heavy silver sutures which penetrated muscles and fasciæ; then, after these had been tied, ran slender wires in every direction across the opening which remained, hoping in this manner to sufficiently reinforce the scar tissue which should form between and around them.

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A quicker procedure, and one which is valuable where the wound edges can be almost or entirely approximated, is that of Phelps, who has treated many inguinal herniæ by placing coiled silver wire on the floor of the canal, and then suturing the other layers of the abdominal wall over it. This alone would not, however, be sufficient for the closure of a large gap, because the small wire coils, lying side by side, could not possibly offer that strong support which can be gained only by anchoring in healthy tissues, wires which shall run like the trusses of a suspension bridge, straight across the weaker portion of the field. Goepel, who was the first to make use of the ready-made filigree, evidently appreciated this principle, for he, by implanting one four by six inches in size upon the muscular layers, was enabled to supply an exceedingly large segment of the abdominal wall. Another of the very few surgical writers who have given us any account of the results attained in this way is Meyer, who reports three cases successfully treated with a netting made up in just the same way that ordinary mosquito bar is constructed. There were certain disturbances in the after-course of one of his cases, but in the end he attained satisfactory results in all three. The disturbances to which I have just referred led to a secondary operation in one instance, and can in my mind be explained by the stiffness of the filigree used, this stiffness being the very objection which I have striven to eliminate in the construction of the little contrivance proposed herein.

All of the above-named authors secured essentially the same results by following the same general line of treatment, but there was considerable difference of detail in the work of each, which becomes a matter of greater import as we go deeper into the subject. Let us then review the technique of the various operators, in order to be able to construct a netting which shall possess none of the features that have proven objectionable in the hands of others, one which shall offer the patient the greatest security together with the minimum possibility of discomfort or danger. One can readily imagine the difficulty of Witzel's procedure of manufacturing a filigree in the tissues while an operation is in progress; but he cannot know just how hard it is until he has tried it. I most heartily subscribe to the idea of putting in a ready-made filigree, for the further very good reason that the surgeon who has measured the wound before operation and manufactured the wire support beforehand can, as a matter of course, make for his patient a much more satisfactory as well as a better fitting one than any which can be devised while the individual is upon the table, amid the hurry and embarrassing surroundings of an extensive surgical procedure. It is equally important that the ready-made filigree can be anchored between the tissue layers at a much greater distance from the lips of the wound than is possible where the whole thing must be made with a needle while the wound is open; it being a matter of physical impossibility to perfectly elevate the tissues and to work between or beneath them at a great distance from the free wound edge without more handling of the tissues and more laceration than is commensurate with satisfactory healing and repair. It is necessarily a slow procedure and likely, in consequence, to be attended with faulty asepsis, while much as a matter of course depends upon this last-named factor, especially since a foreign substance is being incorporated in the body tissues. Then the small silver coils of Phelps cannot be expected to support the scar barrier across a large new opening, useful as they are in their proper place. Those at the periphery would no doubt hold perfectly, while those at the centre, not being attached to them, would as a matter of course allow of separation from the others. The net used by Meyer has been referred to as possessing more stiffness than desirable, when the tissues in which it is to be embedded are extremely pliable, and should in my opinion be subjected to the presence of only such a filigree as will permit the exercise of this quality to the fullest extent. Dr. Meyer's net-work consisted of wires crossing at right angles and equidistant from one another, which method of weaving cannot fail to lend a more or less board-like consistence to the finished product. My results attained in the use of a less bulky contrivance will show that there is no necessity for such a number of wires running in two directions.

The form of filigree which I herewith introduce depends upon the knowledge that scars in the abdominal wall spread laterally but not longitudinally to any great extent, and my results in the cases to be described bear out the truth of this line of reasoning. After considerable observation, it seems to me illogical to strengthen the scar with a great number of needless wires which run parallel to the axis of the incision and which, beside being of no avail, can by their presence serve only to stiffen the abdominal wall, and thus prevent the perfect mobility which has been mentioned as essential to it, being, so to speak, a prerequisite of the patient's comfort.

My filigree depends, as you will see by the appended illustration (Fig. 1), for its efficacy upon the fact that all but one of its wires run across the long axis of the scar and penetrate

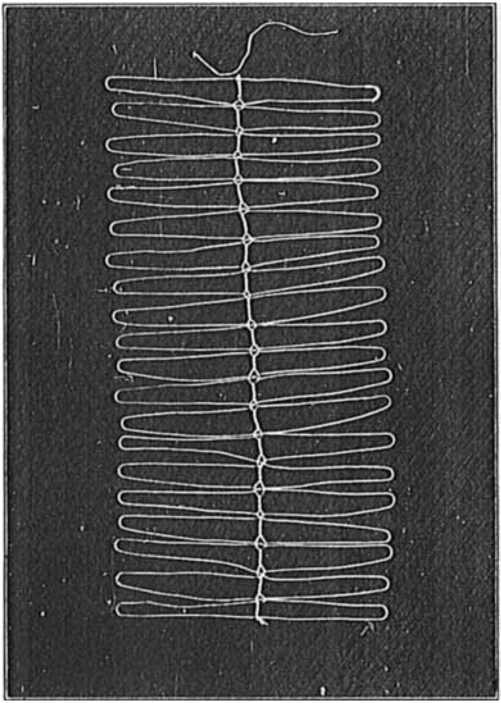

FIG. 2.—Represents a modification of No. 1 (without the median connecting wire). The cut shows only one-third of a net which should be the same size and shape as that in Fig. 1.

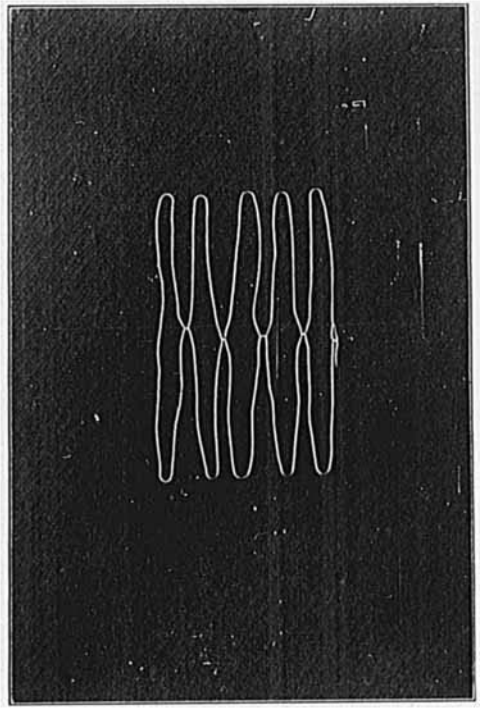

FIG. 1.—Represents the form of filigree which is proposed for general use.

for a distance of one or two inches between the tissue layers, where they are firmly anchored, not by sutures, which I consider perfectly useless in this connection, but by newly formed scar tissue, which naturally fills out the opening of each loop while the patient is in bed after the operation. I purposely bend each of these cross-wires into the form of a loop in order that there shall be no sharp irritating ends anywhere; and, further, I lay great stress, in constructing my filigree, upon the fact that each of these loops be entirely separated at the free end from its neighbor; thus it is seen that the minimum of stiffening is imparted to the tissues by the single longitudinal twist which binds the several loops together in the median line of the contrivance. This last-named wire strand appears necessary to prevent the possibility of a hernia between two of the cross-wires, which might easily be forced slightly apart if they were not fastened together at all. One can hardly imagine the difference in pliability between such a filigree and one woven of wires crossing at right angles and equidistant from each other throughout the whole field. The latter, by its rigidity, can have only the effect of robbing the abdominal wall of much of its natural pliability.

In cases that allowed of no accurate determination beforehand as to the size of filigree desired, I have used a form of net which differs slightly in its construction from that described above. The illustration (Fig. 2) of a short one given herewith shows that this can be drawn out or shut up like an old-fashioned hat-rack. It is different from Fig. 1, inasmuch as no median wire twist binds the cross loops together; however, this has been compensated for in my work by sewing it in place with a continuous suture of fine wire, being careful to loop the suture around each point of crossing in the filigree.

Nothing is easier to make than one of these wire nettings; after trying several methods, I have found it simplest to drive wire nails through a board (their distance apart being regulated by the size of the filigree desired), after which the board is turned over and the points of the nails are used to string the loops upon, much as the lace-weavers use their pins. The one shown in Fig. 1, with twenty loops on either side, is five by two and one-half inches in size, one which has been found convenient in postoperative herniæ. As to the distance between the cross-wires, I can only say that experience has not yet shown that it is to be improved upon. The shape of the contrivance, too, can be modified as the surgeon may see fit; for the inguinal region a triangle has been suggested, and this would surely suit the requirements of the region if one of its sides were fitted to Poupart's ligament. It has been my practice to make use of a gauge 27 silver wire, with which I have as yet no fault to find; I tried aluminum bronze once, but found it far too stiff for the purpose.

It seems that most of the surgeons who have used a filigree have sewn its edges firmly into the tissues, something which I believe to be entirely superfluous. I have never done anything of the kind; still, none of my seven have shown any disposition to pull out. It is surely sufficient to attach the longitudinal twist to its tissue bed by a few sutures, and thus prevent the filigree from slipping before the operation is finished; but any further attachment is merely a waste of time and a needless tissue laceration, since there can be no displacement after granulations have filled out the loops. Then, too, scar formation is certainly complete before the patient is let out of bed at the end of three weeks, as has been my practice. I have but to mention the well-known difficulty of removing gauze or a fenestrated drainage tube into which granulations have grown, to quiet any fears that may obtain as to a filigree moving while the reparative process is going on.

It is hardly possible, regarding the layers between which the filigree should be inserted, to formulate a rule which will cover every case. This is a matter which has depended, in my practice, largely upon the ease with which certain layers have come apart. It may, however, be stated as a general conclusion that it is logical to place the contrivance as deeply as possible, especially since it is used chiefly where the wound edges cannot be brought together, and dead spaces must be obliterated. Suppose an instance in which only peritoneum (with attached fat and transversalis fascia possibly) and skin can be entirely brought together, then it must appeal to any one as being better that the filigree rest upon the floor of the defect rather than outside the muscles, for it is then easier by pressure or suture to prevent the formation of dead spaces between filigree and skin than those between filigree and peritoneum. In no case is the appliance to be placed upon the aponeurosis of the external oblique, since an exposure of that tissue, sufficient for the purpose, must result in a necrosis of it, on account of the cutting off of its blood supply which comes through its covering of fat.

It may seem like a radical stand to take, but experience teaches me that it makes absolutely no difference whether the muscles and fasciæ be or be not completely drawn together as long as a suitable wire filigree extending sufficiently far out between healthy layers be properly implanted and heal in. I have had the opportunity of observing that the anatomical and functional results are just as good where the newly formed segment of the wall is composed of peritoneum, wire, and skin, as is the case under any other circumstances which the most imaginative mind can conceive.

After observing how well my filigrees functionated in several patients, I became naturally curious to learn just how much tension the loops could withstand, after being anchored in no other way than by scar tissue formed in them; so I opened up the abdominal wall of a small dog, separating the intact peritoneum from the overlying structures in the median line, where I embedded a small filigree like Fig. 1. This small contrivance had only eight loops on each side, and projected out but three-fourths of an inch under the edge of the wound, not being sutured in position at all (to make the test the more severe). The recti were then sewn together with a continuous silver wire as was their anterior sheaths, the skin being united by interrupted sutures of silk. The animal was then turned loose without a dressing of any kind, and from the second day he ran around as such animals are accustomed to do under ordinary circumstances, furnishing in this way what can well be considered a crucial test for this method of wound closure.

At the expiration of four weeks, the wound having healed completely, I cut down at one side of the original incision, until the loops forming one edge of the filigree came into view; into four of these I fastened a hook, and then it was only after a tension measured by eleven pounds on a spring balance had been applied that I managed to loosen the hold which four loops on the opposite side had secured. It was then by no means possible to lift the filigree from its bed; the best that could be done in this line was to tear it to pieces, so firmly had nature anchored it. While such an experiment does of course not actually indicate the amount of resistance which such an appliance will manifest against the intra-abdominal pressure directed against its median portion and at right angles to the direction of its cross-wires, still, this is enough to demonstrate that forty such loops, forming both sides of the filigree which I have used on the human subject, will certainly manifest sufficient resistance for all practical purposes, when it requires a full eleven pounds to dislodge only four of them.

There is still another question of decided importance which comes up in this connection, upon which I regret to say we have no definite information, *i.e.*, the influence of such a device upon the abdominal wall of a growing child or upon that of a pregnant woman. Does it have the effect of retarding or of misdirecting the expansion of the part affected? Or do other segments compensate, by an unusual increase in their dimensions, for what is lacking in this new condition of affairs? However this may be, I cannot throw light upon this subject, as I had at one time hoped to do; for, as you will later learn, one of my patients, three and one-half years old, in whom I implanted such an appliance, died long before sufficient time had elapsed for her to furnish us with satisfactory data bearing upon this point.

CASE I.—Ruby G., three and one-half years old, colored, fell some six weeks ago, striking the right side against a hall banister. At the site, between last rib and crest of ilium, there is now a rapidly growing soft mass the size of a lemon; no increased tem-

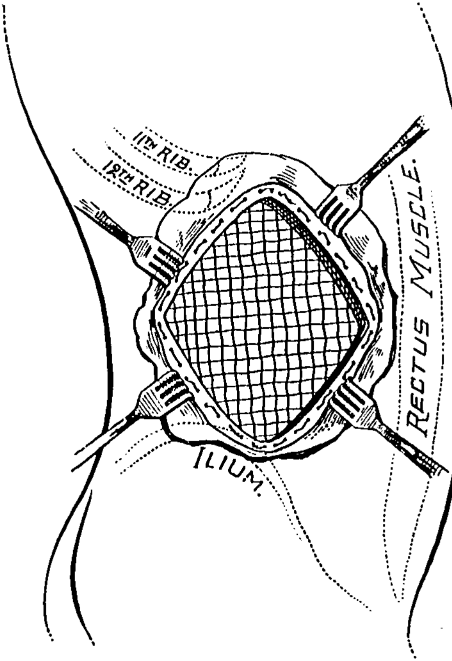

FIG. 3.—The form of filigree which was built up in the tissues during operation in Case I.

perature, no fluctuation, and no change in the skin, which is free from the mass in the deeper layers of the abdominal wall. On April 5, 1901, I excised at the Provident Hospital what was found to be a small round-cell sarcoma, taking at the same time every tissue which was in any way connected with it. After retraction of extensive skin flaps, I removed a rectangular segment of the abdominal wall down to the subperitoneal fat, which was in no way connected with the tumor; this segment contained the twelfth costal cartilage in its upper angle, a portion of the crest of the ilium in its lower, while the anterior portion of the defect exposed the rectus abdominis; and the posterior, the vertebral column. It was manifestly impossible to close so vast a defect by any form of autoplasty, so I set about to construct in the tissues a filigree. This I did with gauge 25 silver wire, being careful to anchor every strand through and through all the tissues except the skin and peritoneum; just how this was done is perhaps better shown by Fig. 3 than any words of mine can describe. There was absolutely no bulging when the patient struggled in the effort at vomiting, so the skin was sewn over the net-work and the child put to bed. The wound healed by first intention, and in three weeks the little one was allowed to get up and run around. There was never at any time evidence that the patient realized the presence of the filigree, nor did the wall ever bulge at the site; in fact, there was never a manifestation of those undesirable consequences which must have followed such an operation had no such means of closing the abdomen been adopted. Fig. 4, made from a photograph taken two months after the operation, shows conclusively that the wire net did its work. This most interesting subject, from whom I had hoped much in the way of showing what effect a filigree has on the development of the abdominal wall, died, three and one-half months after the operation, of a recurrence *in situ*. The wires were found to be evenly scattered through the new masses of sarcoma tissue.

CASE II.—Mr. S., middle-aged white man, on whom omentopexy (Talma's operation) had been performed six months before I treated him. His hepatic cirrhosis manifestations had improved in many respects; still, there was sufficient reaccumulation of the ascitic fluid to cause a small hernia; though I can say from personal observation that the former operation had been well done, and that the wound had healed by first intention. So much discomfort was caused by this hernia that he applied to me for a second operation, and June 8, 1901, I implanted a filigree at the Rebekah Hospital. The sac was dissected out, the recti and their sheaths being freely exposed, but the peritoneum not opened. I placed upon the floor of the wound thus formed a filigree, two by four inches in size, of aluminum bronze wire gauge 30. This contrivance was not quite like those which I now use, being made up of cross-wires woven over a single wire frame; however, it was a step in what I have learned to consider the right direction, since it did not have a large number of wires running parallel to the incision, and thus adding stiffness to the net. As is stated in what has gone before, I have discarded any sort of permanent frame, preferring to have all the cross wires end in separate loops. I did not let out the excess of ascitic fluid; hence the muscles and their sheaths failed to meet over the filigree by almost an inch; their edges were separately made to approach within an inch of each other by the use of a running suture of silver wire; and when the skin was united over this, it is seen that a portion of the anterior abdominal wall consisted of nothing but peritoneum, wire filigree, and skin; that, too, in an individual whose abdomen was gradually filling with ascitic fluid. Could a more severe test of the method be imagined? What I have just said applies to the lower four-fifths of the wound, which is still intact after two years have elapsed. I cannot say as much for the upper fifth, the portion which my filigree did not quite cover; at the operation I covered the small defect with coils of wire fashioned after those of Phelps; still, this part of the wound broke down as soon as the patient got out of bed, and there is now at the site a bulging area about the size of half a walnut. It causes no trouble, however, so he will not allow a reoperation. Nothing of what is written here is meant in criticism of Phelps's valuable method; he probably never meant for it to be used where nothing but skin lies in front of the wire and nothing but peritoneum behind it. While I am far from considering lightly human health or comfort, still, I cannot repress a certain feeling of satisfaction over the reoccurrence of a hernia in the portion of this wound not covered by the filigree; nothing else could so perfectly demonstrate the value of the filigree as this living exposition of the difference between that portion of a wound thus protected and that to which no such protection is afforded.

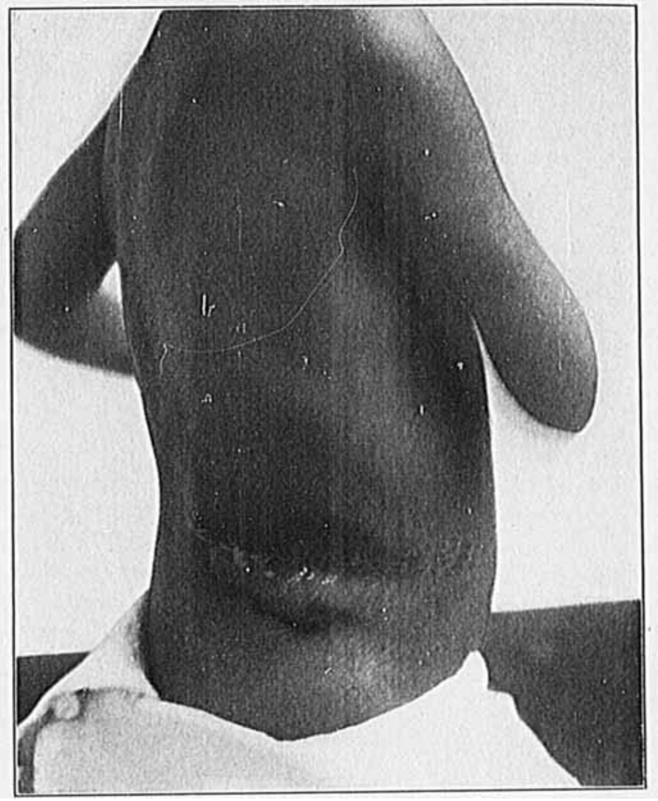

FIG. 4.—Photograph of patient No. 1 two months after operation.

CASE III.—Miss Y., aged eighteen years, was operated upon at St. Anthony's Hospital, July 1, 1902. She was a beautiful and accomplished young woman, whose plight was especially pitiable for these reasons. She had been operated upon for a suppurative appendicitis five years before, and the wound drained for weeks with gauze and rubber tubes. The unfortunate girl had had a hernia ever since getting out of bed; at the time I saw here there was a skin scar one and one-half inches broad by six inches long, which furnished but a thin covering for the hand as it was inserted through a large opening directly into the abdominal cavity. She had worn an abdominal "binder" from the time of the first operation, hence the hernia had been prevented from assuming large proportions. Even with this support she was unable to stand for more than a few minutes at a time; nor could she run, dance, skate, or engage in anything which required an actual exertion. She could not stand straight at all, while her subjective symptoms of weakness and discomfort were most marked. But it was only after removal of her supporter that the actual meaning of such a condition for an otherwise healthy young girl became apparent. She could not stand long enough for me to make a thorough examination of the old wound, and assured me that she had actually not been upon her feet, without the bandage, since the operation of five years before.

I excised the large skin scar, freshened the edges of the aponeurosis, dissected away scar tissue until I had a new muscle wound formed on one side by the rectus, on the other by the internal oblique, and replaced into the abdomen the sac, to the interior of which omentum was widely attached. The muscles could not be brought together without too much tension, so I placed a small filigree made like Fig. 2 on the floor of the defect, and then drew the muscles as nearly as possible together with four Halsted mattress sutures of gauge 23 silver wire. The edges met in three of the sutures, but the fourth left a gap of about an inch immediately over the filigree just mentioned. Upon the muscles I placed a filigree like Fig. 1, one and one-half by five inches in size, completely uniting the aponeurosis over this by a continuous suture of silver wire. After uniting the skin with a subcuticular suture, we put the patient to bed, where she lay for three weeks without an incident to mark the perfect recovery. She got up from bed a changed girl; there was no feeling of weakness in the abdominal wall, nor any sense of discomfort whatever; she felt no desire for the old-time "binder," nor has she had it on since. The right side of the abdominal wall was, as far as her feelings went, exactly like the left, *i.e.*, perfect. This patient's brother informed me seven months after the operation that his sister then walked a mile to school every day, danced like other girls, and had skated the entire afternoon and evening previous to our conversation. Could one hear a more satisfactory commentary of the silver filigree? Nine months after the operation, I received a letter from the young lady, stating that she then weighed some twenty pounds more than she did when she left the hospital, and was otherwise in perfect physical condition.

CASE IV.—Mr. H., fifty-five years old, short, stout, and plethoric, had been operated upon for appendicitis one year before he came under my treatment; it had been a non-suppurative case, and the abdomen had in consequence not been drained, but sewn tight. Nevertheless a hernia had developed shortly after he left the hospital, and when I examined him I found three separate small sacs protruding with their contents of hollow viscera between the sites of the original through-and-through sutures. This patient, like the foregoing, was in constant misery; he suffered actual torment, though he wore a binder; was the subject of colicky pains or constipation all the time, and was, generally speaking, about as miserable as a man can be. I excised everything from the skin to the sac, at the same time freshening the aponeurosis and muscle edges as in the case just described. The openings into the sac were so small that I was afraid to reduce them lest an intra-abdominal constriction might occur. Three Halsted mattress sutures of wire closed the large opening in peritoneum and muscles, then upon the floor thus formed I placed a filigree like Fig. 1, six inches by two and one-half inches in size. Over this the aponeurosis was sewn with one continuous wire and the skin with another. This operation was done at St. Anthony's Hospital, July 28, 1902, and the patient left his bed at the expiration of three weeks a well man in every particular. I saw him eight months after the operation, when I was assured by him that he had never during that time been reminded of the presence of the filigree, nor had he been other than a perfectly well man as far as his abdomen was concerned. This for an elderly gentleman with a pendulous abdomen, who had suffered acutely.

CASE V.—Mr. P., sixty-seven years of age, was operated upon at the Lutheran Hospital, August 12, 1902. The old gentleman suffered from cirrhosis of the liver, with much ascites, and an umbilical hernia the size of a child's head. The heart and kidneys, however, manifested no evidence of change, so I determined to make his condition more bearable if possible. At the operation the sac was found to be filled with small intestines, which were reduced without difficulty through a ring two inches in diameter, there being but one small adhesion. All the coverings on the hernia were extirpated, the surfaces of the liver, spleen, and abdominal wall vigorously rubbed, and the omentum fixed according to Talma's method. Then the layers of the wall around the ring were carefully dissected apart, so that the peritoneum and posterior coverings of the rectus could be united in a single running wire suture. Upon the layer thus formed there was implanted a filigree corresponding to Fig. 1, the dimensions of which were five inches by two and one-half inches. The edges of the very atrophic rectus, together with the anterior sheath, were united over this contrivance with a continuous heavy wire suture. Upon this fibrous layer was fastened a filigree two and one-half inches square and the skin sewn over all. There were no untoward symptoms for four days, at the expiration of which time I departed for Colorado on my summer vacation. What was my surprise, upon returning to the city several weeks later, to learn that, eleven days after the operation, the patient, who was apparently doing well up to that time, had been seized with sudden nausea and expired in ten minutes. No autopsy was made, so I am at a loss for an explanation of the unfortunate occurrence.

CASE VI.—Mrs. S., aged forty years, was operated upon at St. Anthony's Hospital on the 20th of January, 1903, there being removed from the groin what proved to be a carcinoma. I excised skin, subcutaneous tissue, and aponeurosis as well as fascia lata from an area about the size of a man's palm, distributed two-thirds of it above Poupart's ligament, and extending from the superior anterior spine of the ilium most of the way to the spine of the pubis. The defect in the fibrous structures could not be obliterated by simple suture, and, fearing to trust to the muscles alone for maintaining the integrity of the abdominal wall, I implanted a filigree like Fig. 2, consisting of ten loops on either side. This was laid on the muscle floor of the wound, while over its borders was drawn the edge of the aponeurosis and fascia lata, the crossing of the wires being attached to the stump of Poupart's ligament. A defect about one inch broad by three inches long remained in the fibrous covering of the filigree after the edges of these structures had been approximated as nearly as possible by a continuous wire mattress suture. The skin wound was completely closed by the Michel wound "clips." The recovery was uninterrupted; the patient was up in two weeks, walked without trouble, and there was no bulging. The abdominal wall remained intact up to the time of the patient's death from general carcinosis five months after operation.

CASE VII.—Miss H., aged twenty-two years, colored, had been kicked in the right groin two months before I saw her, and had been in bed ever since. When she endeavored to stand up, there was a decided feeling of weakness in the right lower segment of the abdominal wall, accompanied by a sickening discomfort, which caused her to lie down for relief. She had noticed a bulging at the site of the injury, which corresponded fairly well to the inguinal canal; and, indeed, when she stood for me to examine her it was plain that she had not been mistaken in this particular, the lesion being subject to a pronounced impulse on coughing. The corresponding segment of the wall on the left side showed no evidence of change. It was clear that, though no pronounced herniation had occurred since she had remained in bed, something in the way of a repair must be instituted if the otherwise robust, healthy girl was ever to be of any use to herself or to any one else; so I operated at the Provident Hospital, February 28, 1903. The incision was made high, as recommended by Halsted in his operation for inguinal hernia. As soon as the aponeurosis was split, it was seen that the inguinal canal had not enough intact muscle substance in its posterior wall to prevent the hand pushing the peritoneum before it through a large opening into the abdominal cavity. I had little confidence in the thinned-out muscle, so made no attempt to use it in closing the opening, preferring to merely place a filigree of the style in Fig. 2 on the floor of the defect, and to sew the aponeurosis over it with a continuous silver wire. One side of the contrivance was covered by the shelving edge of Poupart's ligament, and the other extended well up between the internal oblique and the aponeurosis. It was two and one-half inches broad and about three and one-half inches long when sewn in place; the adjustable feature of it seeming to me an advantage when used in this locality, because this renders it easier of insertion. The skin was united with the Michel wound "clips," and the girl made a perfect recovery, her wound, like all of the other six, having healed by first intention throughout. In two weeks she left her bed without a feeling of weakness or discomfort, and was able to walk for the first time since the injury, some ten weeks previous to this time. I learned from her family physician, some four months after the operation, that her abdominal wall was still in perfect condition, though there is a slight feeling of stiffness in the scar, as she expresses it, this being particularly noticeable when the thigh is strongly flexed upon the pelvis.

My results have been the legitimate outcome of the operations alone; there have been no favoring circumstances to which may be attributed a share in preventing the expulsion of the filigree by the intra-abdominal tension. I mean by this that I have not allowed one of my patients to wear any sort of binder or support or abdominal bandage after the operation, preferring to put the filigree solely on its merits.

It will be seen from the foregoing that I have done this comparatively new operation seven times, and have seen uniformly perfect results in all but one case. Here the slight partial bulging which resulted under the influence of an ascitic collection was in no sense the fault of the method, but due, on the other hand, to a technical flaw. This was the first instance in which I had inserted a ready-made filigree, and in my inexperience I made it too short. Then in inserting it I fully covered the lower angle of the wound, since I realized that the greatest intra-abdominal pressure must come at that point. I had measured this man's scar and hernial opening before manufacturing the filigree, but learned, during this my first operation of the sort, that a proper dissection in such a case requires that the new wound must be made *much* larger than the old scar. Based on this, I should advise others to make the filigree at least one and one-half times longer than the scar which it is to replace.

I have been able to observe my seven patients after operation, respectively, two years, one year, eleven months, five months, four months, three and one-half months, and eleven days, and must say that I have not had to remove a filigree, nor have I seen any disturbance which might be taken to indicate that such a contrivance could not rest indefinitely in its new bed.

The logic of the operation is simple; in it we place no dependence on preformed tissues; in fact, we entirely leave them out of consideration and pin our faith on a new scar, which is prevented from stretching under tension by unyielding silver wires distributed through it in the proper direction.

My opinion of this recent idea in surgery, after giving it the test which I have, cannot be expressed too enthusiastically. The filigree renders easy something which would in many cases be otherwise impossible. By its use hopeless invalids may be restored to health and activity. Of all the various forms of netting which have been used, the simple ones of cross-wires proposed herein appeal to me as being the only ones which are free from the evident disadvantages inherent to any sort of plate, such as a stiff filigree really is,—one made up of wires which are equidistant and running in both directions.